

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-107294

(43)Date of publication of application : 10.04.2002

(51)Int.Cl.

G01N 21/35

G01N 21/85

// G01N 33/02

(21)Application number : 2000-296856

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(22)Date of filing : 28.09.2000

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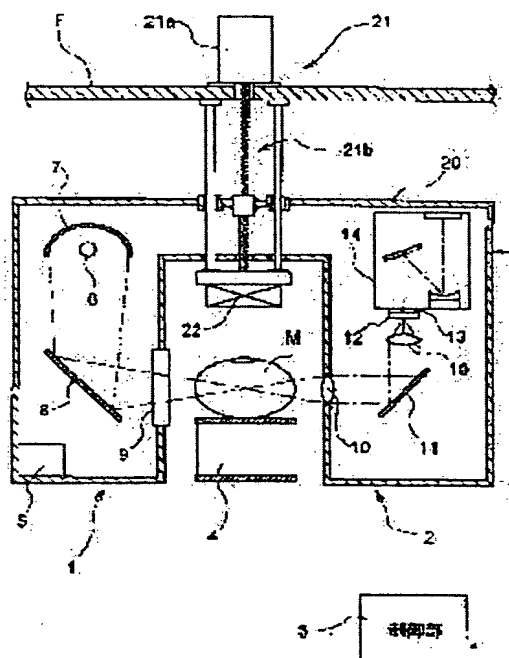
## (54) SPECTRAL ANALYZER

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a spectral analyzer capable of improving the measuring precision.

SOLUTION: This device comprises a projecting means 1 for emitting a light to a matter M to be measured located in a measuring position; a light receiving means 2 for spectrally dividing the transmitted light from the matter M to be measured and receiving the spectrally divided light by a charge accumulating type light receiving sensor 18 to provide its spectral data; and a control means 3 for controlling the operation of each part and analyzing the internal quality of the matter M to be measured on the basis of the spectral data. Before executing a main measuring processing for measuring the spectral data for analyzing the internal quality, a preliminarily

measuring processing for emitting light to the measuring matter to be measured and obtaining light receiving data from the transmitted light is executed, and the charge accumulation time in the execution of the main measuring processing is changed and adjusted on the light receiving data obtained by the preliminary measuring processing so that the charge accumulation quantity of the light receiving sensor 18 is a set to be proper quantity.



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**LEGAL STATUS**

[Date of request for examination] 18.09.2002

[Date of sending the examiner's decision of rejection] 30.09.2004

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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JAPANESE [JP,2002-107294,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM  
MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] Carry out the spectrum of a floodlighting means to irradiate light, and the transmitted light or the reflected light from said measured object to the measured object located in the part for measurement, and the light which carried out the spectrum is received with a charge storage-type photo sensor. a spectrum, while controlling a light-receiving means to obtain spectrum data, and actuation of each part It is spectral-analysis equipment constituted by having the control means which analyzes the internal quality of a measured object based on spectrum data. said spectrum -- said spectrum for said control means to analyze said internal quality, before performing this measurement processing which measures spectrum data It is constituted so that preliminary measurement processing in which irradiate light, carry out the spectrum of the transmitted light or the reflected light from a measured object to the measured object used as the candidate for measurement, receive the light which carried out the spectrum, and light-receiving data are obtained may be performed. And based on the light-receiving data obtained by said preliminary measurement processing, so that the charge accumulated dose of said photo sensor may turn into a setting proper amount Spectral-analysis equipment constituted so that modification adjustment of the floodlighting reinforcement of said floodlighting means when carrying out modification adjustment of said charge storage time when performing said this measurement processing, or performing said this measurement processing may be carried out.

[Claim 2] It is constituted so that it may pass through said part for measurement and said measured object may be conveyed with a conveyance means. Said control means It is constituted so that it may follow on said measured object arriving at said part for measurement and said preliminary measurement processing may be performed. Spectral-analysis equipment according to claim 1 which is constituted so that said this measurement processing may be performed, and is constituted so that modification adjustment of said charge storage time when performing the measurement processing of this or said floodlighting reinforcement may be carried out after the preliminary measurement processing is completed.

[Claim 3] It is spectral-analysis equipment according to claim 2 constituted so that said measured object may be equipped with a globular form or almost globular form appearance configuration, and said control means may perform said preliminary measurement processing for the field by the side of the conveyance direction front end of said measured object and said this measurement processing may be performed for the field of the conveyance direction central site of a measured object.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the spectral-analysis equipment used in order to analyze the internal quality of measured objects, such as garden stuff. In detail Carry out the spectrum of a floodlighting means to irradiate light, and the transmitted light or the reflected light from said measured object to the measured object located in the part for measurement, and the light which carried out the spectrum is received with a charge storage-type photo sensor. a spectrum -- while controlling a light-receiving means to obtain spectrum data, and actuation of each part -- said spectrum -- it is related with the spectral-analysis equipment constituted by having the control means which analyzes the internal quality of a measured object based on spectrum data.

[0002]

[Description of the Prior Art] In the spectral-analysis equipment of the above-mentioned configuration in the former As shown in JP,7-229840,A as said light-receiving means For example, after carrying out the spectrum of the light in a concave grating, the line sensor of the charge storage mold which arranged the photo detector which consists of two or more optoelectric transducers etc. in the shape of an array etc. is used. the spectrum measured with such a light-receiving means -- based on spectrum data, it was constituted so that the internal quality of measured objects, such as garden stuff, might be analyzed. and the spectrum by the light-receiving means while measuring the magnitude (diameter) of a measured object, so that a measured object is conventionally [ above-mentioned ] large in a configuration according to the measurement result -- it was constituted so that the charge storage time when measuring spectrum data might become long, and modification adjustment of the charge storage time might be carried out.

[0003]

[Problem(s) to be Solved by the Invention] Conventionally [ above-mentioned ], a configuration measures the magnitude (diameter) of a measured object and as a configuration adjusted so that a measured object is large and the charge storage time by the photo sensor may become long according to the magnitude Also as opposed to that from which the magnitude of each measured object differs according to the difference in the condition of growth, or a form like the agricultural products of a mandarin orange etc. as a measured object Although the charge storage time is made to change according to the magnitude of a measured object and it enables it to obtain an always proper charge accumulated dose based on the technical viewpoint of changing the permeability of light according to the magnitude Conventionally [ this ], in a configuration, there was the following disadvantage and there was still room of an improvement.

[0004] Namely, conventionally [ above-mentioned ], in a configuration, although proposed also to that from which the magnitude of each measured object differs based on the technical viewpoint of changing the permeability of light according to the magnitude These people found out by the experimental result that the relation between the magnitude of a measured object and the permeability of light was not what always has the specific correlation even if it is the case where the agricultural products of a mandarin

orange etc. are assumed as a measured object. The measurement result by these people who measured the correlation of each magnitude (diameter) and the light-receiving reinforcement by the photo sensor based on standard exposure conditions about the measured object (mandarin orange) about two or more mandarin oranges as a measured object to drawing 7 is shown. It is clear that it is not what permeability differs also in the magnitude of a certain thing as the inclination for permeability to become small, so that a measured object becomes large with the same relation between the magnitude of a measured object and the permeability of light, greatly, and always has the specific correlation from this drawing. [0005] incidentally, it expresses that the contents of a display of each point in drawing 7 (an angle, a round head, x, \*\*) are as a result of [ of a form different, respectively ] measurement, even when a form is the same, magnitude varies, but it is shown that permeability varies, even if it is the same form and is the same magnitude.

[0006] Therefore, sufficient measurement precision cannot be acquired only by considering as the configuration which makes the charge storage time change according to the magnitude of each measured object like the above-mentioned conventional technique. If it is the measured object which light tends to penetrate compared with the permeability assumed when the charge storage time will have been set up for a long time according to it, for example since the appearance of a measured object is size if explanation is added, there is a possibility that the charge storage time may be too long and a charge accumulated dose may be saturated for example, exceeding the maximum accumulated dose. Moreover, if the appearance of a measured object is smallness, and it is the measured object which light cannot penetrate easily compared with the permeability assumed when the charge storage time is shorter set up according to it, the charge storage time is insufficient for a short \*\* past \*\*\*\*\* accumulated dose, an S/N (signal-to-noise) ratio falls, a measurement error becomes size, and there is a possibility that it may be immeasurable with a sufficient precision.

[0007] This invention is made paying attention to this point, and the purpose is in the point of offering the spectral-analysis equipment it becomes possible whose to raise measurement precision.

[0008]

[Means for Solving the Problem] A floodlighting means to irradiate light at the measured object located in the part for measurement according to claim 1, the transmitted light or the reflected light from said measured object -- a spectrum -- carrying out -- the light which carried out the spectrum -- a charge storage-type photo sensor -- receiving light -- a spectrum, while controlling a light-receiving means to obtain spectrum data, and actuation of each part In the spectral-analysis equipment constituted by having the control means which analyzes the internal quality of a measured object based on spectrum data said spectrum -- said spectrum for said control means to analyze said internal quality, before performing this measurement processing which measures spectrum data It is constituted so that preliminary measurement processing in which irradiate light, carry out the spectrum of the transmitted light or the reflected light from a measured object to the measured object used as the candidate for measurement, receive the light which carried out the spectrum, and light-receiving data are obtained may be performed. And based on the light-receiving data obtained by said preliminary measurement processing, so that the charge accumulated dose of said photo sensor may turn into a setting proper amount It is characterized by being constituted so that modification adjustment of the floodlighting reinforcement of said floodlighting means when carrying out modification adjustment of said charge storage time when performing said this measurement processing, or performing said this measurement processing may be carried out.

[0009] namely, the spectrum for analyzing internal quality -- before performing this measurement processing which measures spectrum data, modification adjustment carries out in the charge storage time when performing this measurement processing, or modification adjustment carries out in the floodlighting reinforcement of a floodlighting means so that said preliminary measurement processing performs and the charge accumulated dose of a photo sensor may become with a setting proper amount based on the light-receiving data obtained by the preliminary measurement processing. That is, before performing this measurement processing, it is based on the light-receiving data obtained by the actual measured object by irradiating light. The transparency condition of an actual light in the measured object

can be distinguished. From the light-receiving data For example, the charge storage time required since the charge accumulated dose of a photo sensor turns into a setting proper amount, making it the same floodlighting reinforcement as the time of preliminary measurement processing, Or it can ask for the floodlighting reinforcement by the floodlighting means required since the charge accumulated dose of a photo sensor turns into a setting proper amount in the same charge storage time as preliminary measurement processing etc. By performing this actual measurement processing based on such conditions, measurement processing can be performed in the condition that the charge accumulated dose of a photo sensor turns into a setting proper amount.

[0010] therefore, the spectrum for analyzing internal quality based on the actual measurement result of a measured object on measurement conditions from which the charge accumulated dose of a photo sensor turns into a setting proper amount, since this measurement processing which measures spectrum data is performed A charge accumulated dose is saturated like the above-mentioned conventional configuration, or a charge accumulated dose is insufficient, an S/N (signal-to-noise) ratio falls, and it becomes possible to perform measurement processing with a sufficient precision in the disadvantageous condition of not being generated, like a measurement error becomes size.

[0011] It is constituted so that according to claim 2 it may pass through said part for measurement and said measured object may be conveyed with a conveyance means in claim 1. Said control means It is constituted so that it may follow on said measured object arriving at said part for measurement and said preliminary measurement processing may be performed. After preliminary measurement processing is completed, it is characterized by being constituted so that said this measurement processing may be performed, and being constituted so that modification adjustment of said charge storage time when performing this measurement processing or said amount of floodlighting may be carried out.

[0012] That is, it will follow on a measured object being conveyed with a conveyance means and arriving at the part for measurement, and preliminary measurement processing and this measurement processing will be performed in the sequence, respectively. Therefore, as sequential conveyance of the measured object is continuously carried out with a conveyance means, it becomes possible to often perform measurement processing, and a suitable means to carry out claim 1 is acquired.

[0013] According to claim 3, in claim 2, it is characterized by being constituted so that said measured object may be equipped with a globular form or almost globular form appearance configuration, and said control means may perform said preliminary measurement processing for the field by the side of the conveyance direction front end of said measured object and said this measurement processing may be performed for the field of the conveyance direction central site of a measured object.

[0014] That is, after a measured object equipped with a globular form or almost globular form appearance configuration following on arriving at the part for measurement and performing preliminary measurement processing for the field by the side of the conveyance direction front end of a measured object, this measurement processing is performed for the field of the conveyance direction central site of a measured object. therefore, the spectrum for analyzing internal quality, since it was made having performed this measurement processing for the field of the conveyance direction central site of a measured object even if it was a measured object equipped with a globular form or almost globular form appearance configuration, being able to perform preliminary measurement processing and this measurement processing well to the measured object conveyed -- it becomes that it is possible to perform this measurement processing which measures spectrum data with a sufficient precision. There is little surroundings lump light by which the light on which it was projected from the floodlighting means will be received a surroundings lump and directly with a light-receiving means in the periphery section of a measured object in the field of the conveyance direction central site if explanation is added, it becomes possible to measure in the condition with few measurement errors, and a suitable means to carry out claim 2 is acquired.

[0015]

[Embodiment of the Invention] Hereafter, about the spectral-analysis equipment concerning this invention, it prepares for the fruit-sorting facility which performs sorting classification of a mandarin orange as a measured object, and the case where it applies to the configuration which measures the

internal quality information of a mandarin orange, i.e., a sugar content, acidity, etc., is explained based on a drawing.

[0016] The floodlighting section 1 as a floodlighting means by which this spectral-analysis equipment irradiates light at the measured object M (mandarin orange) as shown in drawing 1, the light which penetrated the measured object M -- a spectrum -- carrying out -- the light which carried out the spectrum -- receiving light -- a spectrum -- with the light sensing portion 2 as a light-receiving means to obtain spectrum data. It has the control-section 3 grade as a control means which controls actuation of each part, and is constituted. The measured object M. It has become column-like at the setting rate by conveyance conveyor 4 as a conveyance means at the single tier with the configuration by which installation conveyance is carried out, and it is constituted so that it may pass through the part for measurement by this spectral-analysis equipment one by one. And after the light projected from the floodlighting section 1 penetrates the measured object M to the measured object M located in the part for measurement, in the condition that light is received by the light sensing portion 2, the floodlighting section 1 and a light sensing portion 2 distribute to the right-and-left both-sides part of the part for measurement, and are arranged.

[0017] The reflecting mirror 8 sideways changed towards the measured object M which said floodlighting section 1 reflects the reflected light by that reflecting plate 7 while having the halogen lamp 6 as an emitter which emits light with the power supplied from a power circuit 5, and the reflecting plate 7 of the concave surface configuration reflected towards a lower part side so that the light which emits light from this halogen lamp 6 may be made to condense, and is located in the part for measurement is formed. Furthermore, the shutter device 9 which can be freely switched to the condition that the light reflected with the reflecting mirror 8 is irradiated by the part for measurement, and the condition of intercepting light is established.

[0018] In said light sensing portion 2. The condenser lens 10 which condenses the light which penetrated the measured object M, the reflecting mirror 11 which reflects light upward, the color filter 12 which passes only the light of a wavelength field for measurement which is mentioned later, and the shutter device 13 which can be freely switched to the open condition of passing light, and the closed state which intercepts light, if incidence of the light which passed the shutter device 13 of an open condition is carried out -- the light -- a spectrum -- carrying out -- said spectrum -- it has the spectroscope 14 grade which measures spectrum data, and is constituted. The reflecting mirror 16 which reflects the light which carried out incidence from ON \*\*\*\* 15 as said spectroscope 14 is shown in drawing 2, the spectrum which carries out the spectrum of the reflected light to the light of two or more wavelength -- with the concave grating 17 as a means detecting the optical reinforcement for every wavelength in which the spectrum was carried out by the concave grating 17 -- a spectrum -- the photo sensor 18 which measures spectrum data has composition arranged in the black box 19 which consists of a protection-from-light nature ingredient which shades the light from the outside. Said photo sensor 18 consists of 1024-bit MOS mold line sensors which change and output the transmitted light by which the part light reflex was carried out by the concave grating 17 to the signal for every wavelength while receiving light for every wavelength to coincidence. Although a detailed explanation is not carried out, this line sensor carries out the interior of the drive circuit for making the capacitor which accumulates the charge obtained in optoelectric transducers, such as a photodiode, and the optoelectric transducer of those for every unit pixel, and its stored charge output outside etc., and is constituted. In addition, the charge storage time by the capacitor can be made to change through a drive circuit from the exterior now. And the light of the wavelength of the range of 700nm - 1100nm can be detected now.

[0019] Said floodlighting section 1 and light sensing portion 2 can be prepared in the condition of being supported in one with the frame 20 prepared so that the upper part side of the part for measurement through which the measured object M passes might be bypassed, and this frame 20 can carry out now modification accommodation of the location of the vertical direction of that whole to the conveyance conveyor 4 by the vertical regulatory mechanism 21. Although a detailed explanation is not carried out about the vertical regulatory mechanism 21, it can be installed in the state of location immobilization to a fixed part F, and can be made to move up and down by screw delivery device 21b driven in electric



motor 21a. And you make it located in the upper part side of the passage part of the measured object M in said conveyance conveyor 4, and the reference filter 22 which is an example of a criteria object is formed in the condition that location immobilization is carried out, by said fixed part F. This reference filter 22 consists of light filters which have a predetermined absorbance property, and, specifically, is constituted using opal glass.

[0020] And by carrying out centering control of said whole frame 20 in the vertical direction As it is indicated in drawing 3 (b) as the usual measurement condition received by the light sensing portion 2 after the light from the floodlighting section 1 penetrates the measured object M laid in the conveyance conveyor 4, as shown in drawing 3 (b) After the light from each floodlighting section 1 penetrates said reference filter 22, it is constituted so that it can switch to the reference measurement condition received by the light sensing portion 2.

[0021] And said conveyance conveyor 4 has the composition of driving endless rotation band 4a by electric motor 4b. It has the rotary encoder 23 which detects the rotation condition of the revolving shaft of body-of-revolution 4c which winds the endless rotation band 4a. The detection information on this rotary encoder 23 also has the composition of being inputted into a control section 3, and further, as shown in drawing 5, the conveyance direction superior side part of said part for measurement by the conveyance conveyor 4 is equipped with the optical passage sensor 24 which detects passage of the measured object M. Photogenic organ 24a which emits light, and electric-eye 24b which receives that light this passage sensor 24 it distributes to the right-and-left both-sides section of the conveyance path by the conveyance conveyor 4, and is arranged, if the light which the measured object M did not exist but emitted light from photogenic organ 24a is received in electric-eye 24b, it will be in an OFF state, and light is interrupted by the measured object M, and light receives light in electric-eye 24b -- it has -- it can kick and will be in an ON state.

[0022] Said control section 3 is constituted using the microcomputer, and as shown in drawing 4, it is constituted so that actuation of each part may be controlled. That is, it has composition which controls actuation of each part, such as modification accommodation of the supply voltage supplied to the halogen lamp 6 in said floodlighting section 1, the switching action of the shutter device of floodlighting section 1 and light sensing portion 2 each and actuation of the vertical regulatory mechanism 21, and a modification control action of the charge storage time in a spectroscope 14. And this control section 3 is constituted so that data processing which analyzes the internal quality of the measured object M may be performed based on the measurement result obtained with the spectroscope 14.

[0023] Next, the control action by the control section 3 is explained. In advance of the usual measurement to the measured object M, a control section 3 replaces the light from the floodlighting section 1 with the measured object M, and irradiates said reference filter 22. the spectrum which carried out the spectrum of the transmitted light from the reference filter 22 by the light sensing portion 2, received the light which carried out the spectrum, and was obtained -- spectrum data -- criteria -- a spectrum -- with the criteria data measurement mode for which it asks as spectrum data Spectrum data are obtained. the measured object M conveyed by conveyance conveyor 4 -- receiving -- the floodlighting section 1 to light -- irradiating -- measurement -- a spectrum -- this measurement -- a spectrum -- spectrum data and said criteria -- a spectrum -- the internal quality of the measured object M is analyzed based on spectrum data -- it is usually constituted free [ a switch in data measurement mode ].

[0024] If it explains in full detail, in said criteria data measurement mode, it is in the condition of stopping conveyance of the measured object M by the conveyance conveyor 4, and the vertical regulatory mechanism 21 will be operated and said frame 20 will be switched to said reference measurement condition. and the spectrum which switched said each shutter device to the open condition, replaced the light from the floodlighting section 1 with the measured object M, irradiated said reference filter 22, carried out the spectrum of the transmitted light from the reference filter 22 by the light sensing portion 2, received the light which carried out the spectrum, and was obtained -- spectrum data -- criteria -- a spectrum -- it measures as spectrum data.

[0025] And in said criteria data measurement mode, the detection value (dark current data) of the photo

sensor 18 in the non-light condition that the light to a light sensing portion 2 was intercepted is also measured. That is, he switches the shutter device of said light sensing portion 2 to a closed state, and is trying to calculate the detection value in every unit pixel of the photo sensor 18 at that time as dark current data.

[0026] Next, the control action in data measurement mode is usually explained. The object M measured [ this / in data measurement mode, operate the vertical regulatory mechanism 21, usually switch a frame 20 to a measurement condition, and according to the conveyance conveyor 4 ] is conveyed. and -- whenever each \*\*\*\*\* M passes through the part for measurement -- each measurement -- a spectrum -- spectrum data are measured. this measurement -- a spectrum -- in case spectrum data are performed, a control section 3 The measured object M follows on the conveyance direction front end location passing through the part for measurement, and is aimed at the field by the side of the conveyance direction front end of a measured object. said spectrum for performing preliminary measurement processing in which irradiate light, carry out the spectrum of the transmitted light to a measured object, receive the light which carried out the spectrum, and light-receiving data are obtained, and analyzing internal quality for the field of the conveyance direction central site of a measured object after that -- this measurement processing which measures spectrum data is performed. In said preliminary measurement processing, the detection value within the setup time by the photo sensor 18 (reserve measured value) is calculated for the field by the side of the conveyance direction front end of the measured object M. And it is made to carry out modification adjustment of the charge storage time when performing this measurement processing based on the light-receiving data obtained by preliminary measurement processing, so that the charge accumulated dose of a photo sensor 18 may turn into a setting proper amount.

[0027] In addition, standard magnitude differs according to the difference in a form, two or more steps of standard criteria data about the charge storage time set up the mandarin orange as a measured object in this equipment based on experimental data etc. according to the difference in such a form beforehand, and it memorizes. namely, as shown in drawing 6, the shorter charge storage time Tx1 as a thing corresponding to the standard permeability to the form of a minor diameter is set up, and as a thing corresponding to the standard permeability of the form to the form of the magnitude like inside The charge storage time Tx2 like inside is set up, and the longer charge storage time Tx3 is set up as a thing corresponding to the standard permeability of the form to the form of a major diameter. And in an actual measurement activity, the thing of them which corresponds either will be chosen and the operating condition in a control section 3 will be set up with the command means which is not illustrated.

[0028] If explanation is added about the concrete processing in an actual activity, the conveyance direction tip location of each \*\*\*\*\* M first conveyed in the part for measurement based on the bearer rate of the conveyance conveyor 4 detected by the rotary encoder 23 and the detection information by said passage sensor 24 and the conveyance direction mid gear of the measured object M will ask for the timing which begins to pass through the part for measurement beforehand. That is, since the output of a passage sensor will switch from an OFF state to an ON state if the measured object M begins to be detected by the passage sensor 24, and it switches from an ON state to an OFF state after the measured object M ends passage, the conveyance direction tip location of the measured object M can ask for the timing which passes through the part for measurement from the measurement information and information on the bearer rate of the conveyance conveyor 4.

[0029] And as shown in the timing chart of drawing 6, the conveyance direction front end location of the measured object M repeats twice the empty reading actuation between [ whose ] the setup times Ts carries out empty reading of the detection value of a photo sensor 18 from the timing T1 which passes through the part for measurement. Then, light income measurement processing (an example of said preliminary measurement processing) in which the detection value (reserve measured value) of a photo sensor 18 is read over the setup time Tu is performed. the detection value by the light income measurement processing -- a spectrum -- it does not use as spectrum data but the charge storage time in this measurement performed after that is used based on the measurement result as an index for carrying out modification adjustment that a charge accumulated dose should be made a setting proper amount. In addition, after predetermined time passes, he is trying for performing empty reading actuation twice to

measure light income, since the measurement error by surroundings lump light is large if the conveyance direction front end location of the measured object M measures light income immediately to the timing T1 which passes through the part for measurement while extracting the charge which the capacitor has already stored electricity. Moreover, as shown in drawing 6, a modification setup of the setup time Tu which performs light income measurement processing will be carried out at the measurement conditions by the form so that it may become so long that it is the measured object of the form of a major diameter according to a difference.

[0030] And based on the detection value by said light income measurement processing, increase and decrease of said charge storage time (that from which it is chosen of Tx1, Tx2, and Tx3 either) of accommodation are carried out at the value which is needed in order to make a charge accumulated dose into a setting proper amount corresponding to the permeability of the measured object. Relation between this light income and the charge storage time may be beforehand map-ized with experimental data etc., and may be suitably calculated based on operation expression. and the charge storage time set up by doing in this way in this measurement processing -- measurement -- a spectrum -- spectrum data are measured.

[0031] By drawing 6, the conveyance direction mid gear of the measured object M makes timing which passes through the part for measurement a reference point (0), measurement timing is shown in the measured object M of the Onaka smallness various kinds, and T2 shows among drawing the timing to which the conveyance direction termination location of the measured object M passes through the part for measurement by it. Data transfer shows the time amount which transmits measurement data to a control section 3.

[0032] In addition, even if it is the case where modification adjustment of the charge storage time based on the measurement result of light income measurement processing which was described above is performed When the long processing time to which the conveyance direction termination location of the measured object M exceeds the timing which passes through the part for measurement as the proper charge storage time based on a measurement result is found The charge storage time will be amended so that the end time of the charge storage time may become a near side from the timing to which the conveyance direction termination location passes through the part for measurement. Or as long as it is possible to make the supply voltage supplied to this halogen lamp 6 increase, supply voltage is adjusted and you may make it control a power circuit 5 by such condition to make floodlighting reinforcement increase, since it is considered that the floodlighting reinforcement by the halogen lamp 6 is also insufficient.

[0033] Next, it is constituted so that data processing which analyzes the internal quality of the measured object M using the spectral-analysis technique which is a well-known technique based on the various data obtained by doing in this way may be performed. that is, measurement -- a spectrum -- spectrum data and said criteria -- a spectrum -- while acquiring the quadratic differential value in the wavelength field of the absorbance spectrum for every wavelength by which the spectrum was carried out, and an absorbance spectrum based on spectrum data and dark current data, it is constituted so that analysis data processing which computes the amount of components corresponding to the sugar content contained in the measured object M by the quadratic differential value and the amount of components corresponding to acidity may be performed. an absorbance d -- criteria -- a spectrum -- spectrum data -- Rd and measurement -- a spectrum -- if spectrum data are set to Sd and dark current data are set to Da -- [0034]

[Equation 1]

$$d = \log \{ (Rd - Da) / (Sd - Da) \}$$

[0035] Coming out and defining, a control section 3 computes the amount of components contained in the measured object M based on the multiple regression analysis by following several 2.

[0036]

[Equation 2]

$$Y = K0 + K1 \cdot A(\lambda 1) + K2 \cdot A(\lambda 2)$$

[0037] However, Y ; The amounts K0, K1, and K2 of components ; A coefficient A (lambda 1), A (lambda 2) ; quadratic differential value of the absorbance spectrum in the specific wavelength lambda

[0038] In addition, for every component which computes the amount of components, the specific amount formula of components, the specific multipliers  $K_0$ ,  $K_1$ , and  $K_2$  and wavelength  $\lambda_1$ , and  $\lambda_2$  grade are beforehand set up by the control section 3, are memorized, and have at it composition which computes the amount of components of each component using the specific amount formula of components for every component of this.

[0039] [Another operation gestalt] Another operation gestalt is listed hereafter.

[0040] (1) Although considered as the configuration performed after performing two empty reading actuation from the timing to which the conveyance direction front end location of a measured object passes preliminary measurement processing through the part for measurement with the above-mentioned operation gestalt As long as it can cover the surroundings lump light from the floodlighting section to a light sensing portion proper, as it may be made to carry out after one empty reading actuation or empty reading actuation is performed before said timing, it may be made to perform preliminary measurement processing to coincidence with said timing mostly.

[0041] (2) Although the configuration which carries out modification adjustment of said charge storage time when performing said this measurement processing was illustrated with the above-mentioned operation gestalt based on the light-receiving data obtained by preliminary measurement processing so that the charge accumulated dose of said photo sensor might turn into a setting proper amount It may replace with such a configuration, and you may constitute so that modification adjustment of the floodlighting reinforcement of the floodlighting means when performing this measurement processing based on the light-receiving data obtained by said preliminary measurement processing so that the charge accumulated dose of a photo sensor may turn into a setting proper amount may be carried out. Specifically, it is good also as a configuration which controls a power circuit 5 so that the charge accumulated dose of a photo sensor may turn into a setting proper amount, modification accommodation of the supply voltage supplied to a halogen lamp 6 may be carried out and floodlighting reinforcement may be made to change.

[0042] (3) Although the configuration which fixes the bearer rate of the measured object by the conveyance conveyor, and performs measurement processing was illustrated with the above-mentioned operation gestalt, when using for example, such for not only a configuration but for a fruit-sorting facility, it is possible to change a bearer rate in order to raise the throughput of fruit sorting. And when the termination time of the charge storage time by which modification adjustment is carried out according to the increase and decrease of accommodation of a bearer rate in order to make the charge accumulated dose of a photo sensor into a setting proper amount when changing a bearer rate according to an activity situation in this way separates from the field of the conveyance direction central site of a measured object, the supply voltage supplied to a halogen lamp is adjusted, and a power circuit may be made to control to make floodlighting reinforcement increase. Or it is good also as a configuration which carries out adjustable setting of the magnification gain of the amplifier which amplifies the detection value of a photo sensor.

[0043] (4) With the above-mentioned operation gestalt, although the filter by opal glass was used as a criteria object, the quality of the material is not limited that what is necessary is just what has a predetermined absorbance property besides diffusion plates, such as not only this but an obscured glass. Moreover, as a floodlighting means, various kinds of floodlighting means of \*\*, such as not only the halogen lamp 6 but a mercury-vapor lamp, Ne discharge tube, etc., may be used, and you may make it a light-receiving means also use other detection means, such as not only an MOS mold line sensor but a CCD mold line sensor.

[0044] (5) the above-mentioned operation gestalt -- the transmitted light from a measured object -- being based -- a spectrum -- although the spectrum was measured -- not only a configuration such but the reflected light from a measured object -- being based -- a spectrum -- you may make it measure a spectrum

[0045] (6) With the above-mentioned operation gestalt, as internal quality of the measured object M, although a sugar content and acidity were illustrated, the other internal quality, such as information not only on this but a flavor, may be measured.

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the spectral-analysis equipment used in order to analyze the internal quality of measured objects, such as garden stuff. In detail Carry out the spectrum of a floodlighting means to irradiate light, and the transmitted light or the reflected light from said measured object to the measured object located in the part for measurement, and the light which carried out the spectrum is received with a charge storage-type photo sensor. a spectrum -- while controlling a light-receiving means to obtain spectrum data, and actuation of each part -- said spectrum -- it is related with the spectral-analysis equipment constituted by having the control means which analyzes the internal quality of a measured object based on spectrum data.

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PRIOR ART

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[Description of the Prior Art] In the spectral-analysis equipment of the above-mentioned configuration in the former As shown in JP,7-229840,A as said light-receiving means For example, after carrying out the spectrum of the light in a concave grating, the line sensor of the charge storage mold which arranged the photo detector which consists of two or more optoelectric transducers etc. in the shape of an array etc. is used. the spectrum measured with such a light-receiving means -- based on spectrum data, it was constituted so that the internal quality of measured objects, such as garden stuff, might be analyzed. and the spectrum by the light-receiving means while measuring the magnitude (diameter) of a measured object, so that a measured object is conventionally [ above-mentioned ] large in a configuration according to the measurement result -- it was constituted so that the charge storage time when measuring spectrum data might become long, and modification adjustment of the charge storage time might be carried out.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Conventionally [ above-mentioned ], a configuration measures the magnitude (diameter) of a measured object and as a configuration adjusted so that a measured object is large and the charge storage time by the photo sensor may become long according to the magnitude. Also as opposed to that from which the magnitude of each measured object differs according to the difference in the condition of growth, or a form like the agricultural products of a mandarin orange etc. as a measured object. Although the charge storage time is made to change according to the magnitude of a measured object and it enables it to obtain an always proper charge accumulated dose based on the technical viewpoint of changing the permeability of light according to the magnitude. Conventionally [ this ], in a configuration, there was the following disadvantage and there was still room of an improvement.

[0004] Namely, conventionally [ above-mentioned ], in a configuration, although proposed also to that from which the magnitude of each measured object differs based on the technical viewpoint of changing the permeability of light according to the magnitude. These people found out by the experimental result that the relation between the magnitude of a measured object and the permeability of light was not what always has the specific correlation even if it is the case where the agricultural products of a mandarin orange etc. are assumed as a measured object. The measurement result by these people who measured the correlation of each magnitude (diameter) and the light-receiving reinforcement by the photo sensor based on standard exposure conditions about the measured object (mandarin orange) about two or more mandarin oranges as a measured object to drawing 7 is shown. It is clear that it is not what permeability differs also in the magnitude of a certain thing as the inclination for permeability to become small, so that a measured object becomes large with the same relation between the magnitude of a measured object and the permeability of light, greatly, and always has the specific correlation from this drawing.

[0005] incidentally, it expresses that the contents of a display of each point in drawing 7 (an angle, a round head, x, \*\*) are as a result of [ of a form different, respectively ] measurement, even when a form is the same, magnitude varies, but it is shown that permeability varies, even if it is the same form and is the same magnitude.

[0006] Therefore, sufficient measurement precision cannot be acquired only by considering as the configuration which makes the charge storage time change according to the magnitude of each measured object like the above-mentioned conventional technique. If it is the measured object which light tends to penetrate compared with the permeability assumed when the charge storage time will have been set up for a long time according to it, for example since the appearance of a measured object is size if explanation is added, there is a possibility that the charge storage time may be too long and a charge accumulated dose may be saturated for example, exceeding the maximum accumulated dose. Moreover, if the appearance of a measured object is smallness, and it is the measured object which light cannot penetrate easily compared with the permeability assumed when the charge storage time is shorter set up according to it, the charge storage time is insufficient for a short \*\* past \*\*\*\*\* accumulated dose, an S/N (signal-to-noise) ratio falls, a measurement error becomes size, and there is a possibility that it may be immeasurable with a sufficient precision.



[0007] This invention is made paying attention to this point, and the purpose is in the point of offering the spectral-analysis equipment it becomes possible whose to raise measurement precision.

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MEANS

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[Means for Solving the Problem] A floodlighting means to irradiate light at the measured object located in the part for measurement according to claim 1, the transmitted light or the reflected light from said measured object -- a spectrum -- carrying out -- the light which carried out the spectrum -- a charge storage-type photo sensor -- receiving light -- a spectrum, while controlling a light-receiving means to obtain spectrum data, and actuation of each part In the spectral-analysis equipment constituted by having the control means which analyzes the internal quality of a measured object based on spectrum data said spectrum -- said spectrum for said control means to analyze said internal quality, before performing this measurement processing which measures spectrum data It is constituted so that preliminary measurement processing in which irradiate light, carry out the spectrum of the transmitted light or the reflected light from a measured object to the measured object used as the candidate for measurement, receive the light which carried out the spectrum, and light-receiving data are obtained may be performed. And based on the light-receiving data obtained by said preliminary measurement processing, so that the charge accumulated dose of said photo sensor may turn into a setting proper amount It is characterized by being constituted so that modification adjustment of the floodlighting reinforcement of said floodlighting means when carrying out modification adjustment of said charge storage time when performing said this measurement processing, or performing said this measurement processing may be carried out.

[0009] namely, the spectrum for analyzing internal quality -- before performing this measurement processing which measures spectrum data, modification adjustment carries out in the charge storage time when performing this measurement processing, or modification adjustment carries out in the floodlighting reinforcement of a floodlighting means so that said preliminary measurement processing performs and the charge accumulated dose of a photo sensor may become with a setting proper amount based on the light-receiving data obtained by the preliminary measurement processing. That is, before performing this measurement processing, it is based on the light-receiving data obtained by the actual measured object by irradiating light. The transparency condition of an actual light in the measured object can be distinguished. From the light-receiving data For example, the charge storage time required since the charge accumulated dose of a photo sensor turns into a setting proper amount, making it the same floodlighting reinforcement as the time of preliminary measurement processing, Or it can ask for the floodlighting reinforcement by the floodlighting means required since the charge accumulated dose of a photo sensor turns into a setting proper amount in the same charge storage time as preliminary measurement processing etc. By performing this actual measurement processing based on such conditions, measurement processing can be performed in the condition that the charge accumulated dose of a photo sensor turns into a setting proper amount.

[0010] therefore, the spectrum for analyzing internal quality based on the actual measurement result of a measured object on measurement conditions from which the charge accumulated dose of a photo sensor turns into a setting proper amount, since this measurement processing which measures spectrum data is performed A charge accumulated dose is saturated like the above-mentioned conventional configuration, or a charge accumulated dose is insufficient, an S/N (signal-to-noise) ratio falls, and it becomes possible

to perform measurement processing with a sufficient precision in the disadvantageous condition of not being generated, like a measurement error becomes size.

[0011] It is constituted so that according to claim 2 it may pass through said part for measurement and said measured object may be conveyed with a conveyance means in claim 1. Said control means It is constituted so that it may follow on said measured object arriving at said part for measurement and said preliminary measurement processing may be performed. After preliminary measurement processing is completed, it is characterized by being constituted so that said this measurement processing may be performed, and being constituted so that modification adjustment of said charge storage time when performing this measurement processing or said amount of floodlighting may be carried out.

[0012] That is, it will follow on a measured object being conveyed with a conveyance means and arriving at the part for measurement, and preliminary measurement processing and this measurement processing will be performed in the sequence, respectively. Therefore, as sequential conveyance of the measured object is continuously carried out with a conveyance means, it becomes possible to often perform measurement processing, and a suitable means to carry out claim 1 is acquired.

[0013] According to claim 3, in claim 2, it is characterized by being constituted so that said measured object may be equipped with a globular form or almost globular form appearance configuration, and said control means may perform said preliminary measurement processing for the field by the side of the conveyance direction front end of said measured object and said this measurement processing may be performed for the field of the conveyance direction central site of a measured object.

[0014] That is, after a measured object equipped with a globular form or almost globular form appearance configuration following on arriving at the part for measurement and performing preliminary measurement processing for the field by the side of the conveyance direction front end of a measured object, this measurement processing is performed for the field of the conveyance direction central site of a measured object. therefore, the spectrum for analyzing internal quality, since it was made having performed this measurement processing for the field of the conveyance direction central site of a measured object even if it was a measured object equipped with a globular form or almost globular form appearance configuration, being able to perform preliminary measurement processing and this measurement processing well to the measured object conveyed -- it becomes that it is possible to perform this measurement processing which measures spectrum data with a sufficient precision. There is little surroundings lump light by which the light on which it was projected from the floodlighting means will be received a surroundings lump and directly with a light-receiving means in the periphery section of a measured object in the field of the conveyance direction central site if explanation is added, it becomes possible to measure in the condition with few measurement errors, and a suitable means to carry out claim 2 is acquired.

[0015]

[Embodiment of the Invention] Hereafter, about the spectral-analysis equipment concerning this invention, it prepares for the fruit-sorting facility which performs sorting classification of a mandarin orange as a measured object, and the case where it applies to the configuration which measures the internal quality information of a mandarin orange, i.e., a sugar content, acidity, etc., is explained based on a drawing.

[0016] The floodlighting section 1 as a floodlighting means by which this spectral-analysis equipment irradiates light at the measured object M (mandarin orange) as shown in drawing 1 , the light which penetrated the measured object M -- a spectrum -- carrying out -- the light which carried out the spectrum -- receiving light -- a spectrum -- with the light sensing portion 2 as a light-receiving means to obtain spectrum data It has the control-section 3 grade as a control means which controls actuation of each part, and is constituted. The measured object M It has become column-like at the setting rate by conveyance conveyor 4 as a conveyance means at the single tier with the configuration by which installation conveyance is carried out, and it is constituted so that it may pass through the part for measurement by this spectral-analysis equipment one by one. And after the light projected from the floodlighting section 1 penetrates the measured object M to the measured object M located in the part for measurement, in the condition that light is received by the light sensing portion 2, the floodlighting

section 1 and a light sensing portion 2 distribute to the right-and-left both-sides part of the part for measurement, and are arranged.

[0017] The reflecting mirror 8 sideways changed towards the measured object M which said floodlighting section 1 reflects the reflected light by that reflecting plate 7 while having the halogen lamp 6 as an emitter which emits light with the power supplied from a power circuit 5, and the reflecting plate 7 of the concave surface configuration reflected towards a lower part side so that the light which emits light from this halogen lamp 6 may be made to condense, and is located in the part for measurement is formed. Furthermore, the shutter device 9 which can be freely switched to the condition that the light reflected with the reflecting mirror 8 is irradiated by the part for measurement, and the condition of intercepting light is established.

[0018] In said light sensing portion 2 The condenser lens 10 which condenses the light which penetrated the measured object M, the reflecting mirror 11 which reflects light upward, the color filter 12 which passes only the light of a wavelength field for measurement which is mentioned later, and the shutter device 13 which can be freely switched to the open condition of passing light, and the closed state which intercepts light, if incidence of the light which passed the shutter device 13 of an open condition is carried out -- the light -- a spectrum -- carrying out -- said spectrum -- it has the spectroscopy 14 grade which measures spectrum data, and is constituted. The reflecting mirror 16 which reflects the light which carried out incidence from ON \*\*\*\* 15 as said spectroscopy 14 is shown in drawing 2, the spectrum which carries out the spectrum of the reflected light to the light of two or more wavelength -- with the concave grating 17 as a means detecting the optical reinforcement for every wavelength in which the spectrum was carried out by the concave grating 17 -- a spectrum -- the photo sensor 18 which measures spectrum data has composition arranged in the black box 19 which consists of a protection-from-light nature ingredient which shades the light from the outside. Said photo sensor 18 consists of 1024-bit MOS mold line sensors which change and output the transmitted light by which the part light reflex was carried out by the concave grating 17 to the signal for every wavelength while receiving light for every wavelength to coincidence. Although a detailed explanation is not carried out, this line sensor carries out the interior of the drive circuit for making the capacitor which accumulates the charge obtained in optoelectric transducers, such as a photodiode, and the optoelectric transducer of those for every unit pixel, and its stored charge output outside etc., and is constituted. In addition, the charge storage time by the capacitor can be made to change through a drive circuit from the exterior now. And the light of the wavelength of the range of 700nm - 1100nm can be detected now.

[0019] Said floodlighting section 1 and light sensing portion 2 can be prepared in the condition of being supported in one with the frame 20 prepared so that the upper part side of the part for measurement through which the measured object M passes might be bypassed, and this frame 20 can carry out now modification accommodation of the location of the vertical direction of that whole to the conveyance conveyor 4 by the vertical regulatory mechanism 21. Although a detailed explanation is not carried out about the vertical regulatory mechanism 21, it can be installed in the state of location immobilization to a fixed part F, and can be made to move up and down by screw delivery device 21b driven in electric motor 21a. And you make it located in the upper part side of the passage part of the measured object M in said conveyance conveyor 4, and the reference filter 22 which is an example of a criteria object is formed in the condition that location immobilization is carried out, by said fixed part F. This reference filter 22 consists of light filters which have a predetermined absorbance property, and, specifically, is constituted using opal glass.

[0020] And by carrying out centering control of said whole frame 20 in the vertical direction As it is indicated in drawing 3 (b) as the usual measurement condition received by the light sensing portion 2 after the light from the floodlighting section 1 penetrates the measured object M laid in the conveyance conveyor 4, as shown in drawing 3 (b) After the light from each floodlighting section 1 penetrates said reference filter 22, it is constituted so that it can switch to the reference measurement condition received by the light sensing portion 2.

[0021] And said conveyance conveyor 4 has the composition of driving endless rotation band 4a by electric motor 4b. It has the rotary encoder 23 which detects the rotation condition of the revolving shaft

of body-of-revolution 4c which winds the endless rotation band 4a. The detection information on this rotary encoder 23 also has the composition of being inputted into a control section 3, and further, as shown in drawing 5, the conveyance direction superior side part of said part for measurement by the conveyance conveyor 4 is equipped with the optical passage sensor 24 which detects passage of the measured object M. Photogenic organ 24a which emits light, and electric-eye 24b which receives that light this passage sensor 24 it distributes to the right-and-left both-sides section of the conveyance path by the conveyance conveyor 4, and is arranged, if the light which the measured object M did not exist but emitted light from photogenic organ 24a is received in electric-eye 24b, it will be in an OFF state, and light is interrupted by the measured object M, and light receives light in electric-eye 24b -- it has -- it can kick and will be in an ON state.

[0022] Said control section 3 is constituted using the microcomputer, and as shown in drawing 4, it is constituted so that actuation of each part may be controlled. That is, it has composition which controls actuation of each part, such as modification accommodation of the supply voltage supplied to the halogen lamp 6 in said floodlighting section 1, the switching action of the shutter device of floodlighting section 1 and light sensing portion 2 each and actuation of the vertical regulatory mechanism 21, and a modification control action of the charge storage time in a spectroscopy 14. And this control section 3 is constituted so that data processing which analyzes the internal quality of the measured object M may be performed based on the measurement result obtained with the spectroscopy 14.

[0023] Next, the control action by the control section 3 is explained. In advance of the usual measurement to the measured object M, a control section 3 replaces the light from the floodlighting section 1 with the measured object M, and irradiates said reference filter 22. the spectrum which carried out the spectrum of the transmitted light from the reference filter 22 by the light sensing portion 2, received the light which carried out the spectrum, and was obtained -- spectrum data -- criteria -- a spectrum -- with the criteria data measurement mode for which it asks as spectrum data Spectrum data are obtained. the measured object M conveyed by conveyance conveyor 4 -- receiving -- the floodlighting section 1 to light -- irradiating -- measurement -- a spectrum -- this measurement -- a spectrum -- spectrum data and said criteria -- a spectrum -- the internal quality of the measured object M is analyzed based on spectrum data -- it is usually constituted free [ a switch in data measurement mode ].

[0024] If it explains in full detail, in said criteria data measurement mode, it is in the condition of stopping conveyance of the measured object M by the conveyance conveyor 4, and the vertical regulatory mechanism 21 will be operated and said frame 20 will be switched to said reference measurement condition. and the spectrum which switched said each shutter device to the open condition, replaced the light from the floodlighting section 1 with the measured object M, irradiated said reference filter 22, carried out the spectrum of the transmitted light from the reference filter 22 by the light sensing portion 2, received the light which carried out the spectrum, and was obtained -- spectrum data -- criteria -- a spectrum -- it measures as spectrum data.

[0025] And in said criteria data measurement mode, the detection value (dark current data) of the photo sensor 18 in the non-light condition that the light to a light sensing portion 2 was intercepted is also measured. That is, he switches the shutter device of said light sensing portion 2 to a closed state, and is trying to calculate the detection value in every unit pixel of the photo sensor 18 at that time as dark current data.

[0026] Next, the control action in data measurement mode is usually explained. The object M measured [ this / in data measurement mode, operate the vertical regulatory mechanism 21, usually switch a frame 20 to a measurement condition, and according to the conveyance conveyor 4 ] is conveyed. and -- whenever each \*\*\*\*\* M passes through the part for measurement -- each measurement -- a spectrum -- spectrum data are measured. this measurement -- a spectrum -- in case spectrum data are performed, a control section 3 The measured object M follows on the conveyance direction front end location passing through the part for measurement, and is aimed at the field by the side of the conveyance direction front end of a measured object. said spectrum for performing preliminary measurement processing in which irradiate light, carry out the spectrum of the transmitted light to a measured object, receive the light

which carried out the spectrum, and light-receiving data are obtained, and analyzing internal quality for the field of the conveyance direction central site of a measured object after that -- this measurement processing which measures spectrum data is performed. In said preliminary measurement processing, the detection value within the setup time by the photo sensor 18 (reserve measured value) is calculated for the field by the side of the conveyance direction front end of the measured object M. And it is made to carry out modification adjustment of the charge storage time when performing this measurement processing based on the light-receiving data obtained by preliminary measurement processing, so that the charge accumulated dose of a photo sensor 18 may turn into a setting proper amount.

[0027] In addition, standard magnitude differs according to the difference in a form, two or more steps of standard criteria data about the charge storage time set up the mandarin orange as a measured object in this equipment based on experimental data etc. according to the difference in such a form beforehand, and it memorizes. namely, as shown in drawing 6, the shorter charge storage time Tx1 as a thing corresponding to the standard permeability to the form of a minor diameter is set up, and as a thing corresponding to the standard permeability of the form to the form of the magnitude like inside The charge storage time Tx2 like inside is set up, and the longer charge storage time Tx3 is set up as a thing corresponding to the standard permeability of the form to the form of a major diameter. And in an actual measurement activity, the thing of them which corresponds either will be chosen and the operating condition in a control section 3 will be set up with the command means which is not illustrated.

[0028] If explanation is added about the concrete processing in an actual activity, the conveyance direction tip location of each \*\*\*\*\* M first conveyed in the part for measurement based on the bearer rate of the conveyance conveyor 4 detected by the rotary encoder 23 and the detection information by said passage sensor 24 and the conveyance direction mid gear of the measured object M will ask for the timing which begins to pass through the part for measurement beforehand. That is, since the output of a passage sensor will switch from an OFF state to an ON state if the measured object M begins to be detected by the passage sensor 24, and it switches from an ON state to an OFF state after the measured object M ends passage, the conveyance direction tip location of the measured object M can ask for the timing which passes through the part for measurement from the measurement information and information on the bearer rate of the conveyance conveyor 4.

[0029] And as shown in the timing chart of drawing 6, the conveyance direction front end location of the measured object M repeats twice the empty reading actuation between [ whose ] the setup times Ts carries out empty reading of the detection value of a photo sensor 18 from the timing T1 which passes through the part for measurement. Then, light income measurement processing (an example of said preliminary measurement processing) in which the detection value (reserve measured value) of a photo sensor 18 is read over the setup time Tu is performed. the detection value by the light income measurement processing -- a spectrum -- it does not use as spectrum data but the charge storage time in this measurement performed after that is used based on the measurement result as an index for carrying out modification adjustment that a charge accumulated dose should be made a setting proper amount. In addition, after predetermined time passes, he is trying for performing empty reading actuation twice to measure light income, since the measurement error by surroundings lump light is large if the conveyance direction front end location of the measured object M measures light income immediately to the timing T1 which passes through the part for measurement while extracting the charge which the capacitor has already stored electricity. Moreover, as shown in drawing 6, a modification setup of the setup time Tu which performs light income measurement processing will be carried out at the measurement conditions by the form so that it may become so long that it is the measured object of the form of a major diameter according to a difference.

[0030] And based on the detection value by said light income measurement processing, increase and decrease of said charge storage time (that from which it is chosen of Tx1, Tx2, and Tx3 either) of accommodation are carried out at the value which is needed in order to make a charge accumulated dose into a setting proper amount corresponding to the permeability of the measured object. Relation between this light income and the charge storage time may be beforehand map-ized with experimental data etc., and may be suitably calculated based on operation expression. and the charge storage time set up by

doing in this way in this measurement processing -- measurement -- a spectrum -- spectrum data are measured.

[0031] By drawing 6, the conveyance direction mid gear of the measured object M makes timing which passes through the part for measurement a reference point (0), measurement timing is shown in the measured object M of the Onaka smallness various kinds, and T2 shows among drawing the timing to which the conveyance direction termination location of the measured object M passes through the part for measurement by it. Data transfer shows the time amount which transmits measurement data to a control section 3.

[0032] In addition, even if it is the case where modification adjustment of the charge storage time based on the measurement result of light income measurement processing which was described above is performed When the long processing time to which the conveyance direction termination location of the measured object M exceeds the timing which passes through the part for measurement as the proper charge storage time based on a measurement result is found The charge storage time will be amended so that the end time of the charge storage time may become a near side from the timing to which the conveyance direction termination location passes through the part for measurement. Or as long as it is possible to make the supply voltage supplied to this halogen lamp 6 increase, supply voltage is adjusted and you may make it control a power circuit 5 by such condition to make floodlighting reinforcement increase, since it is considered that the floodlighting reinforcement by the halogen lamp 6 is also insufficient.

[0033] Next, it is constituted so that data processing which analyzes the internal quality of the measured object M using the spectral-analysis technique which is a well-known technique based on the various data obtained by doing in this way may be performed. that is, measurement -- a spectrum -- spectrum data and said criteria -- a spectrum -- while acquiring the quadratic differential value in the wavelength field of the absorbance spectrum for every wavelength by which the spectrum was carried out, and an absorbance spectrum based on spectrum data and dark current data, it is constituted so that analysis data processing which computes the amount of components corresponding to the sugar content contained in the measured object M by the quadratic differential value and the amount of components corresponding to acidity may be performed. an absorbance d -- criteria -- a spectrum -- spectrum data -- Rd and measurement -- a spectrum -- if spectrum data are set to Sd and dark current data are set to Da -- [0034] [Equation 1]

$$d = \log\{(Rd - Da) / (Sd - Da)\}$$

[0035] Coming out and defining, a control section 3 computes the amount of components contained in the measured object M based on the multiple regression analysis by following several 2.

[0036]

[Equation 2]

$$Y = K0 + K1 \cdot A(\lambda 1) + K2 \cdot A(\lambda 2)$$

[0037] However, Y ; The amounts K0, K1, and K2 of components ; A coefficient A (lambda 1), A (lambda 2) ; quadratic differential value of the absorbance spectrum in the specific wavelength lambda

[0038] In addition, for every component which computes the amount of components, the specific amount formula of components, the specific multipliers K0, K1, and K2 and wavelength lambda 1, and lambda2 grade are beforehand set up by the control section 3, are memorized, and have at it composition which computes the amount of components of each component using the specific amount formula of components for every component of this.

[0039] [Another operation gestalt] Another operation gestalt is listed hereafter.

[0040] (1) Although considered as the configuration performed after performing two empty reading actuation from the timing to which the conveyance direction front end location of a measured object passes preliminary measurement processing through the part for measurement with the above-mentioned operation gestalt As long as it can cover the surroundings lump light from the floodlighting section to a light sensing portion proper, as it may be made to carry out after one empty reading actuation or empty reading actuation is performed before said timing, it may be made to perform preliminary measurement processing to coincidence with said timing mostly.

[0041] (2) Although the configuration which carries out modification adjustment of said charge storage time when performing said this measurement processing was illustrated with the above-mentioned operation gestalt based on the light-receiving data obtained by preliminary measurement processing so that the charge accumulated dose of said photo sensor might turn into a setting proper amount It may replace with such a configuration, and you may constitute so that modification adjustment of the floodlighting reinforcement of the floodlighting means when performing this measurement processing based on the light-receiving data obtained by said preliminary measurement processing so that the charge accumulated dose of a photo sensor may turn into a setting proper amount may be carried out. Specifically, it is good also as a configuration which controls a power circuit 5 so that the charge accumulated dose of a photo sensor may turn into a setting proper amount, modification accommodation of the supply voltage supplied to a halogen lamp 6 may be carried out and floodlighting reinforcement may be made to change.

[0042] (3) Although the configuration which fixes the bearer rate of the measured object by the conveyance conveyor, and performs measurement processing was illustrated with the above-mentioned operation gestalt, when using for example, such for not only a configuration but for a fruit-sorting facility, it is possible to change a bearer rate in order to raise the throughput of fruit sorting. And when the termination time of the charge storage time by which modification adjustment is carried out according to the increase and decrease of accommodation of a bearer rate in order to make the charge accumulated dose of a photo sensor into a setting proper amount when changing a bearer rate according to an activity situation in this way separates from the field of the conveyance direction central site of a measured object, the supply voltage supplied to a halogen lamp is adjusted, and a power circuit may be made to control to make floodlighting reinforcement increase. Or it is good also as a configuration which carries out adjustable setting of the magnification gain of the amplifier which amplifies the detection value of a photo sensor.

[0043] (4) With the above-mentioned operation gestalt, although the filter by opal glass was used as a criteria object, the quality of the material is not limited that what is necessary is just what has a predetermined absorbance property besides diffusion plates, such as not only this but an obscured glass. Moreover, as a floodlighting means, various kinds of floodlighting means of \*\*, such as not only the halogen lamp 6 but a mercury-vapor lamp, Ne discharge tube, etc., may be used, and you may make it a light-receiving means also use other detection means, such as not only an MOS mold line sensor but a CCD mold line sensor.

[0044] (5) the above-mentioned operation gestalt -- the transmitted light from a measured object -- being based -- a spectrum -- although the spectrum was measured -- not only a configuration such but the reflected light from a measured object -- being based -- a spectrum -- you may make it measure a spectrum

[0045] (6) With the above-mentioned operation gestalt, as internal quality of the measured object M, although a sugar content and acidity were illustrated, the other internal quality, such as information not only on this but a flavor, may be measured.



